

## CLAIMS:

1. A method of concentrating the solids of a liquid suspension comprising:
  - (i) providing a pressure differential across the walls of permeable, hollow membranes immersed in the liquid suspension, said liquid suspension being applied to the outer surface of the porous hollow membranes to induce and sustain filtration through the membrane walls wherein:
    - (a) some of the liquid suspension passes through the walls of the membranes to be drawn off as clarified liquid or filtrate from the hollow membrane lumens, and
    - 10 (b) at least some of the solids are retained on or in the hollow membranes or otherwise as suspended solids within the liquid surrounding the membranes,
  - (ii) periodically backwashing the membrane pores using the filtrate by applying a gas at a pressure below the bubble point to the membrane lumens to 15 progressively displace at least some of the liquid filtrate within the lumens through the membrane pores resulting in removal the solids retained on or in the hollow membranes into the bulk liquid surrounding the membranes.
2. A method of concentrating the solids of a liquid suspension comprising:
  - (i) providing a pressure differential across the walls of permeable, 20 hollow membranes immersed in the liquid suspension, said liquid suspension being applied to the outer surface of the porous hollow membranes to induce and sustain filtration through the membrane walls wherein:
    - (a) some of the liquid suspension passes through the walls of the membranes to be drawn off as clarified liquid or filtrate from the hollow membrane lumens, and

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- (b) at least some of the solids are retained on or in the hollow membranes or otherwise as suspended solids within the liquid surrounding the membranes,
- (ii) dislodging the retained solids from the membranes by applying a
- 5 dislodging medium through the lumens of said membranes while concurrently draining liquid from said lumens, wherein the application of the dislodging medium initially displaces liquid within the hollow membrane lumens through the hollow membrane with gas, to effect firstly a discharge of liquid in the lumens through the membrane walls, and secondly a transmembrane cleaning of the
- 10 membranes by applying the gas at sufficient pressure onto the liquid to overcome the bubble point of the membrane, and ensure that the gas will displace liquid and follow it through the larger pores of the membranes to dislodge any solids retained therein; and for the emerging gas to scour the external walls of the membranes and displace the removed solids into the bulk
- 15 liquid surrounding the membranes.

3. A method of concentrating the solids of a liquid suspension according to claim 1 or 2 wherein said method is carried out as a continuous process utilising a repetitive cycle of solid accumulation and solid displacement or removal.

4. A method of concentrating the solids of a liquid suspension according to  
20 any one of the preceding claims wherein the dislodging or backwashing step includes use of a chemical cleaning solution.

5. A method of concentrating the solids of a liquid suspension according to claim 4 including the step of filtering the chemical cleaning solution from the outer surface of the porous hollow membranes into the membrane lumens, and

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then displacing said chemical cleaning solution back through the membrane pores by application of said gas.

6. A method of concentrating the solids of a liquid suspension according to claim 4 wherein the backwashing or dislodging step includes displacing the  
5 filtrate in a reverse direction through the membrane pores while injecting chemical cleaning solution into the filtrate.
7. A method of concentrating the solids of a liquid suspension according to claim 4 including the step of applying chemical cleaning solution under pressure to the outer surface of the porous hollow membranes to displace chemical  
10 cleaning solution through the membrane pores into the membrane lumens and then displacing said chemical cleaning solution back through the membrane pores by application of said gas.
8. A method according to any one of claims 5 to 7 when appended to claim 1 including the step of removing at least part of the liquid remaining in the  
15 membrane lumens prior to displacing chemical cleaning solution into the membrane lumens.
9. A method according to any one of claims 5 to 7 when appended to claim 2 wherein the displacing of chemical solution into the membrane lumens takes place before said transmembrane cleaning.
- 20 10. A method of concentrating the solids of a liquid suspension according to any one of the preceding claims wherein the gas is pulsed in its application to the membrane lumens.
11. A method of concentrating the solids of a liquid suspension according to any one of the preceding claims including the step of removing at least part of

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the bulk liquid surrounding the membranes prior to the backwashing or dislodging step.

12. A concentrator for recovering fine solids from a liquid feed suspension comprising:

- 5        (i)      a vessel for containing said feed suspension;
- (ii)     a plurality of permeable, hollow membranes within the vessel;
- (iii)    means for providing a pressure differential across walls of said membranes;
- (iv)    means for withdrawing clarified liquid from the membrane; and
- 10       (v)     means for applying gas at a pressure below the bubble point to the liquid permeate in the membrane lumens to effect a discharge of at least some of the liquid permeate in the lumens through the membrane walls to dislodge any solids retained therein and displace the removed solids into the bulk liquid surrounding the membranes.

15      13. A concentrator for recovering fine solids from a liquid feed suspension comprising:

- (i)      a vessel or tank for containing said feed suspension;
  - (ii)     a plurality of permeable, hollow membranes within the vessel or tank;
  - 20       (iii)    means for providing a pressure differential across walls of said membranes;
  - (iv)    means for withdrawing clarified liquid from the membrane; and
  - (v)     means for applying gas pressure to the liquid in the membrane lumens and walls while the vessel or tank is exposed to atmospheric pressure
- 25      and while concurrently draining liquid from said lumens, to effect firstly a

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discharge of liquid in the lumens through the membrane walls, and secondly a transmembrane cleaning of the membranes by applying the gas at sufficient pressure onto the liquid to overcome the bubble point of the membrane, and ensure that the gas will displace liquid and follow it through the larger pores of  
5 the membranes to dislodge any solids retained therein; and for the emerging gas to scour the external walls of the membranes and displace the removed solids into the bulk liquid in the vessel or tank.